

Pavement Preservation with Crack Treatments

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Source

Manual of Practice- FHWA-RD-99-147

“Materials and Procedures for Sealing and Filling Cracks in Asphalt-Surfaced Pavements” (February 2001)

Available through:

Turner-Fairbanks Highway Research Center,
6300 Georgetown Pike, McLean, VA 22101-
2296

www.tfhrc.gov

Crack Treatment- Overview

1. Why?
2. Pavement evaluation
3. Determine if Crack Sealing or Crack Filling treatment is needed
4. Choosing a Crack Sealing vs. Crack Filling Material
 - Determine pavement temperature (high/low extremes)
 - Select product
5. Proper application/equipment

Why Crack Treatment?

“Cracks are inevitable, and neglect leads to accelerated cracking and potholing, further reducing pavement serviceability” (FHWA-RD-99-147)

Why Crack Treatment?

“With proper and timely application, crack sealing and filling can extend pavement life past the point where the cost-benefit of added pavement life exceeds the cost of conducting the operation” (FHWA-RD-99-147)

Why Crack Treatment?

1. To defer the need for other treatments.
2. To improve the performance of other treatments.

Pavement conditions vary.
Before you start have a plan.

Pavement Evaluation and Treatment Selection

- Identify various pavement (cracking) conditions:
 - thermal (transverse),
 - longitudinal,
 - block
 - fatigue (alligator)
- Identify treatments:
 - crack sealing (Working Cracks)
 - performance crack filling (Non Working Cracks)

“Working” vs. “non-working” cracks:

“Working” (high movement)- $\geq 3\text{mm}$ movement

- Thermal

“Non-working” (low or no movement)- $\leq 3\text{mm}$ movement

- Longitudinal

- Block

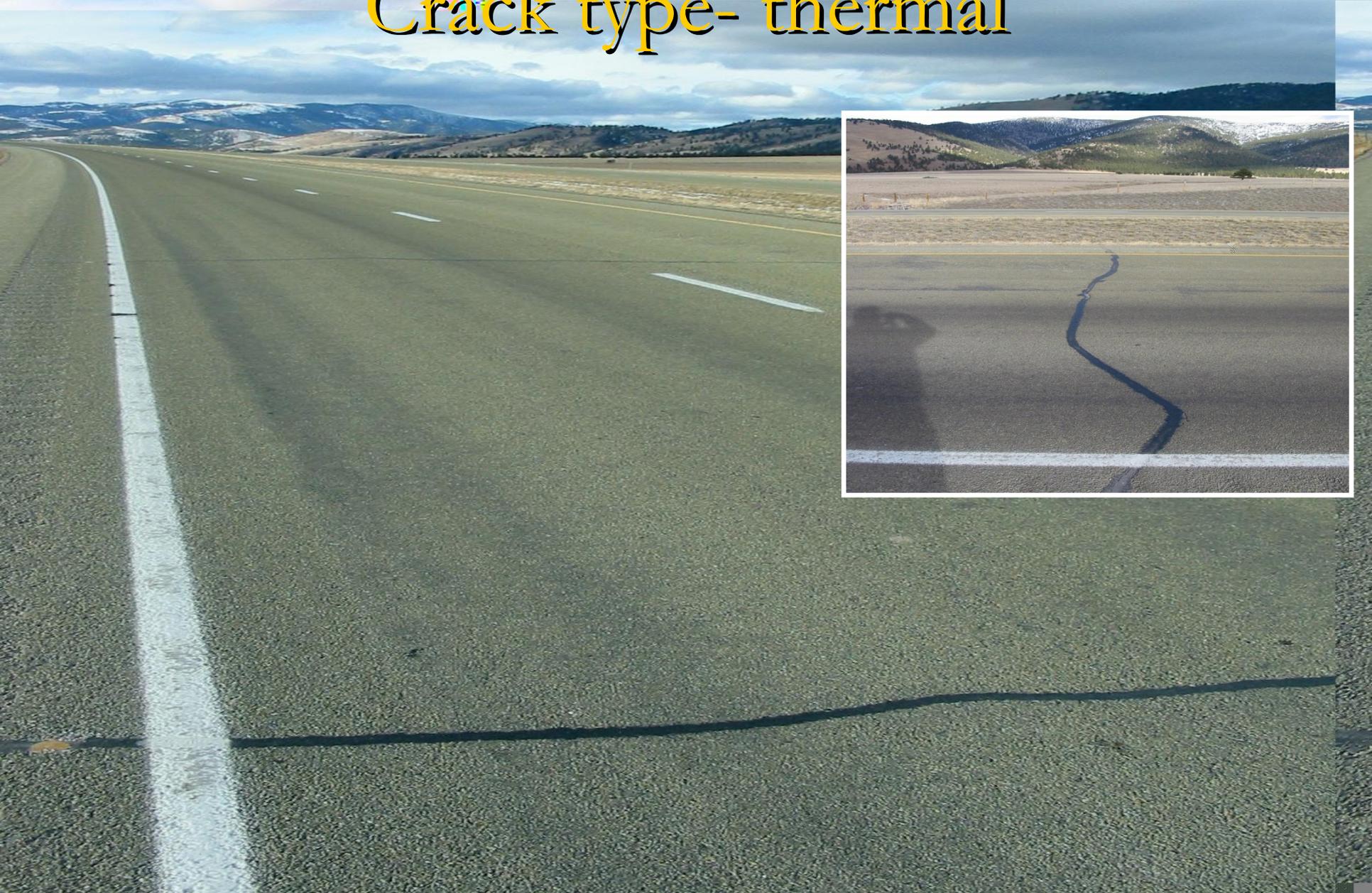
- Fatigue

Type of crack- “thermal [transverse]” (definition)

- Cracks formed by temperature related pavement/sub grade movement
- Generally in transverse direction (perpendicular to center line)
- Generally full width of street or road
- Generally >20 foot spacing
- Considered “**working**” cracks- ≥ 3mm movement
- Will develop in 2-7 years on most new pavements, 1-3 years on overlaid concrete

Crack type – thermal
(reflective)

Crack type- thermal



Crack type- thermal

Crack type- “longitudinal” (definition)

- Can develop in 2-5 years along with thermal cracks
- Occur in longitudinal (parallel to center line) direction
- Caused by thermal movement, construction joints and edge joints
- Considered low movement, “**non-working**” cracks- < 3mm movement

Crack type- longitudinal

Crack type- block

Crack type- “fatigue” [alligator] (definition)

- Caused by repeated traffic loading
- Occurs in heavy traffic areas and wheel paths
- Cracks form in closely spaced, interconnecting block patterns
- Sure sign of pavement structural failure
- Considered low or no movement “**non-working**” cracks- < 3mm movement

Crack type- fatigue

Varying crack movements

- Thermal- “**working**” crack, $\geq 3\text{mm}$ movement
- Longitudinal- “**non-working**” crack, $< 3\text{mm}$ movement
- Block- “**non-working**” crack, $< 3\text{mm}$ movement
- Fatigue- “**non-working**” crack, $< 3\text{mm}$ movement

Two different treatments:

- 1) “Working” cracks- crack sealing- “The placement of specialized treatment materials above or into working cracks using unique configurations to prevent the intrusion of water and incompressibles into the crack” (FHWA-RD-99-147)
- 2) “Non-working” cracks- performance crack filling- “The placement of ordinary treatment materials into non-working cracks to substantially reduce infiltration of water and to reinforce the adjacent pavement.” (FHWA-RD-99-147)

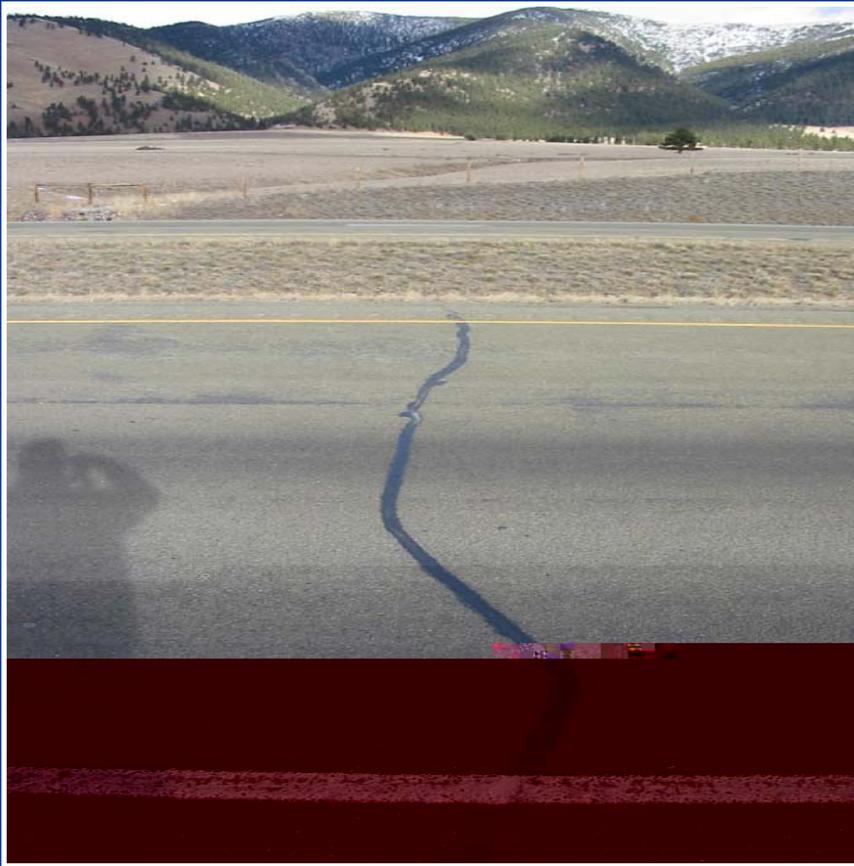
Crack Sealing treatment:

Use:

- In thermal cracks
- Highly elastic (soft) sealant to withstand high movements
- Routed reservoirs
- Pavements in good condition- >20' transverse crack spacing, minor other cracking

Crack Type - Thermal

Crack Treatment - Sealing



Crack Sealing

Proper crack sealing is far more than a band-aid!



Crack Sealing process

Thermal cracks:

- Use routed reservoirs
- Use elastic (soft) sealant to withstand thermal pavement movement

Crack Movement

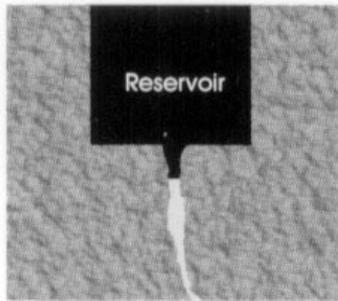
- **Varies with crack spacing**
- **Varies with temperature range - high to low**
- **Greater temperature range = Greater movement**

Routed Reservoir

- Proven longest lasting results in SHRP/FHWA evaluation
- Widened reservoir reduces % of sealant/filler movement

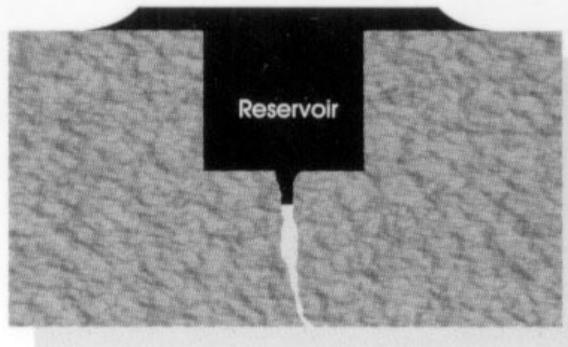
Field Performance

- Wider routs are used in colder climates
- Colder climates have greater temperature range
- Rout width based on temperature range



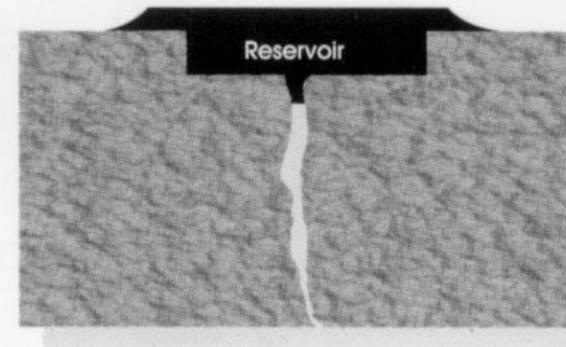
Configuration A

Standard Reservoir-and-Flush



Configuration B

Standard Recessed Band-Aid



Configuration C

Shallow Recessed Band-Aid

Rout Size Recommendation:

Pavement Temp. High to Low (C°)	Minimum Width	Depth
Difference 80° or Less	1/2"	3/4"
86°	3/4"	3/4"
92°	1 1/8"	1/2"
98° and Higher	1 1/2"	1/2"

Crack Sealing Expectations: (FHWA-RD-99-147)

- Rubberized (polymer-modified) asphalt sealants-
5-9 years performance in routed working cracks
- Rubberized (polymer-modified) asphalt sealants-
2.5-5 years performance in unrouted working
cracks

Performance Crack Filling treatment:

Use:

- In longitudinal, block, fatigue and closely spaced transverse cracks (< 20' spacing)
- In wheel paths and high traffic areas
- Sealant is Stiffer more “traffic resistant” product
- Routed or non-routed reservoirs (use discretion), overband application

Crack Filling Process

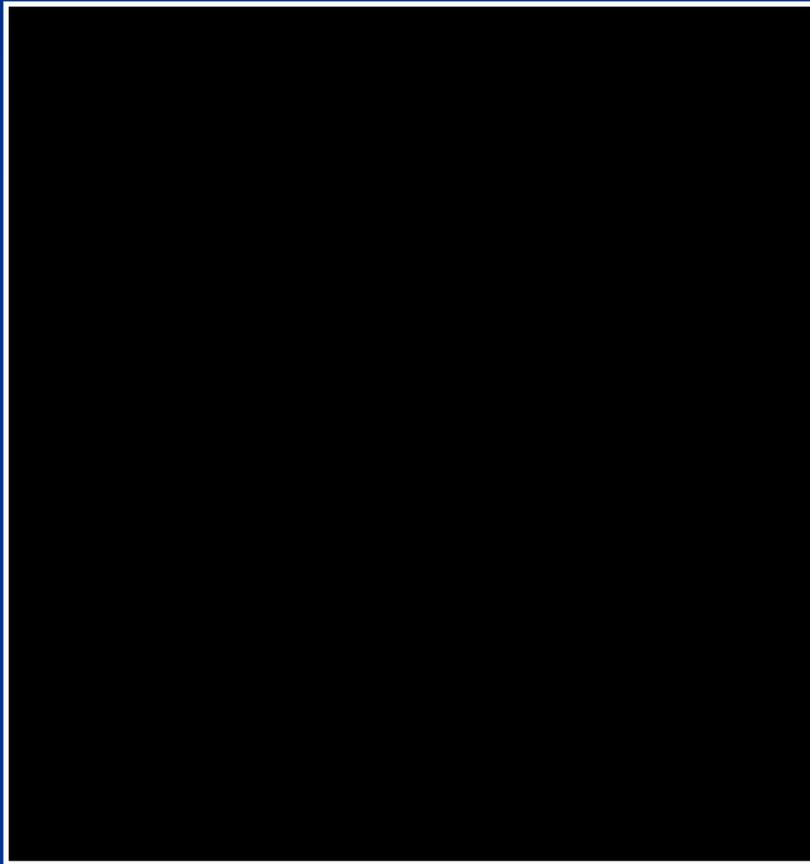
longitudinal, block, fatigue and closely spaced transverse cracks (non working):

Most used crack treatment.

Less preparation than Sealing Treatment in some pavements.

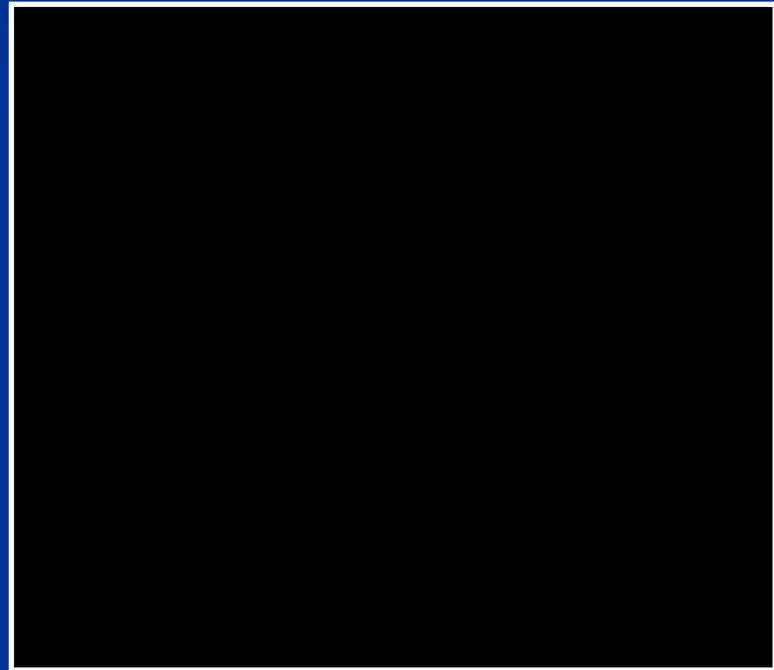
Good Preparation for other preservation treatments.

Crack Type – Non Working Crack Treatment – Filling With Routed Reservoir



Performance crack filling

Block Cracking



Performance crack filling

Fatigue Cracking

Prep for Micro Treatment



Micro after 2 years



Crack Filling Expectations: (FHWA-RD-99-147)

- Emulsion and asphalt cement fillers- 2-4 years performance in unrouted non-working cracks
- Rubber- and fiber-modified asphalt fillers- 6-8 years performance in unrouted non-working cracks

Forget it!!

Sealant Selection

Sealant Selection

Materials for crack sealing and filling need to remain functional over the range of anticipated pavement temperatures.

LTPPBIND



LTPPBIND

(Version 2.1, July 1, 1999)



A Software For:
Determining SUPERPAVE Performance Grades
Based on LTPP and SHRP Pavement Temperature Models
and Data from 7928 Weather Stations in North America

Provided by:
Federal Highway Administration
Turner-Fairbank Highway Research Center
6300 Georgetown Pike, HRDI-13
McLean, VA 22101-2296

[Click here to continue](#)

**Available
On the
Web**

LTPPBIND (Version 2.1, July 1, 1999)

File Select Stations Report View Map Show Stations Help

188 Stations Selected Model:H/L(LTPP/LTPP)

PG Binder selection

Data for 'TEMPE ASU' Weather Station

Latitude, Degree: 33.42

Design Air Temperature, Degree C: HIGH 43.6 LOW -3.6

Air Temperature Standard Deviation, C: 1.3 2.2

Other Inputs

Desired Reliability, %: 98

Depth (Pvt. surface to top of layer, mm): 0

Traffic Load, Million ESAL: 0

Traffic Speed: Fast

Traffic Adjustment

None

SHRP

KMC

User Defined

View / Modify

Pavement Temperature and PG	HIGH	LOW
Design Air Temperature	43.6	-3.6
Design Pavement Temperature	67.0	-5.3
Adjustment for Traffic Speed	+ 0	
Adjustment for Traffic Loading	+ 0	
Adjusted Pavement Temperature	67.0	-5.3
Selected Binder Grade	70	-10

Close PG Chart Print Save Help

Low Pav. Temp. (98% Reliability)

- Use temperature information for your area...
- This may not be the same as the PG asphalt grade used for paving.

Crack Sealant

- Extensible products at low temperature
- High temperature stiffness to resist flow in sealing installations.

Performance Crack Filler...

- Flexible products at low temperature
- High temperature stiffness (traffic resistant) in filling applications.

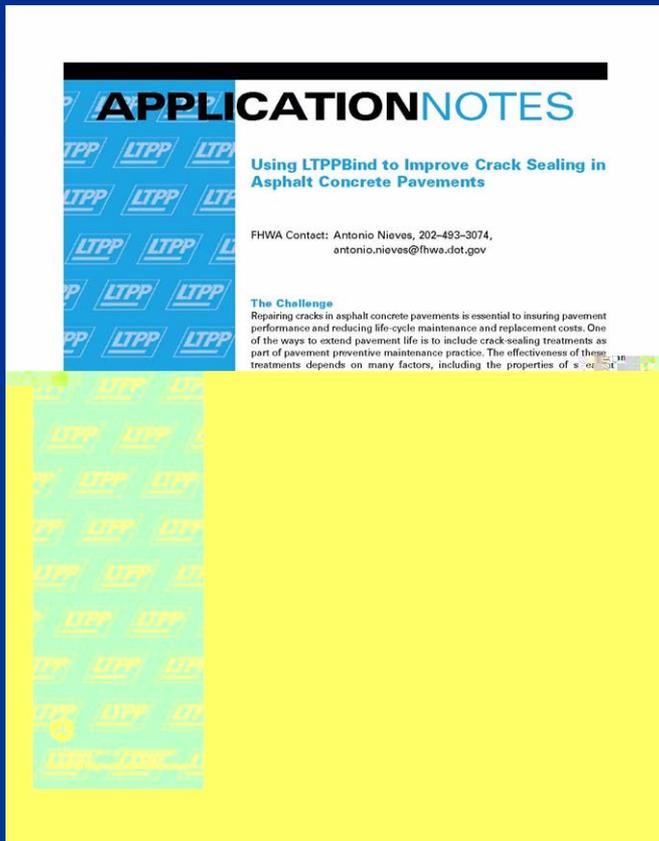
Traffic Adjustment

Filling use only

Extreme conditions - parking lots, high traffic, slow traffic, foot traffic, etc.

Use high temperature grade 1 or 2 higher.

Material Selection



Determine temperature ranges with LTPPBind

- ❑ www.tfhrc.gov/pavement/ltpp/reports/03080/
- ❑ www.tfhrc.gov/pavement/ltpp/ppt/bind.ppt
- ❑ www.fhwa.dot.gov/pavement/ltpp/bind/download

INSTALLATION PROCESS

Installation Choices:

- **Rout or not?**
 - **Size of rout?**
- **Cleaning Method?**
- **Recess, Flush, Over-band?**

Cleaning Methods

- **Compressed air**
 - sufficient pressure and velocity
 - Clean & dry
- **Vacuum**
- **Heat lance**
 - Warm pavement when needed
- **Routing**
 - Cuts new bonding surface
 - Create a reservoir

Cleaning Methods



Cleaning Methods

HOT-AIR LANCE



Hot Air Lances should be used to dry slightly moist pavement or heat pavement up to 40°F.

THIS PAVEMENT IS TOO WET. HOT-AIR LANCE WILL NOT BE EFFECTIVE. MOISTURE WILL RE-ENTER CRACK BEFORE SEALANT IS APPLIED.

Proper Routing Equipment



New Cutter

Worn Cutter

Worn Cutters will not provide a good reservoir.



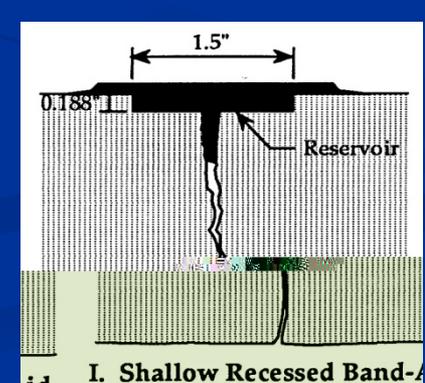
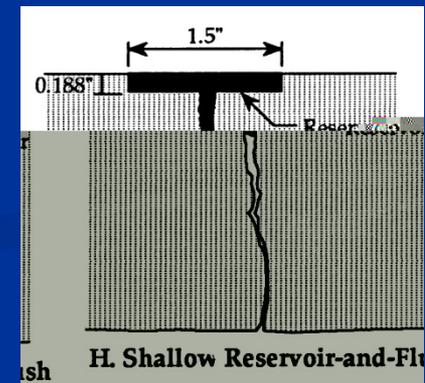
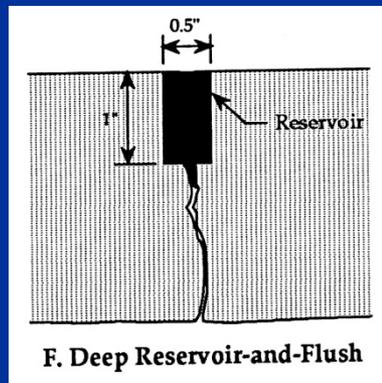
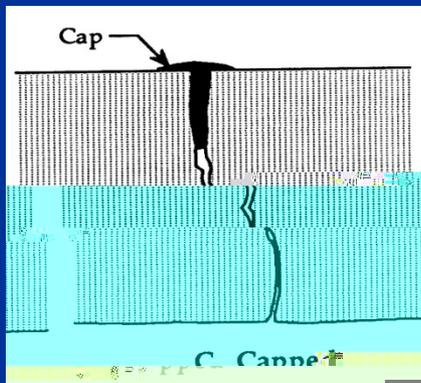
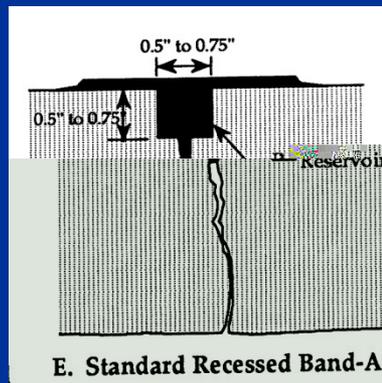
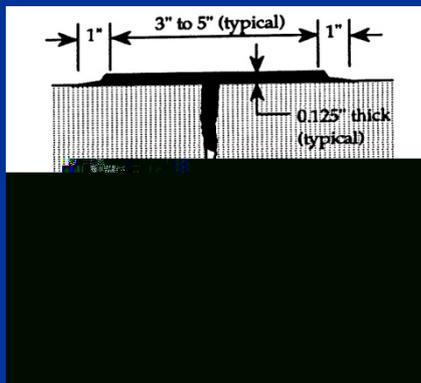
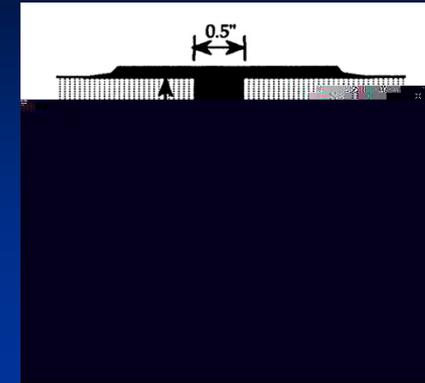
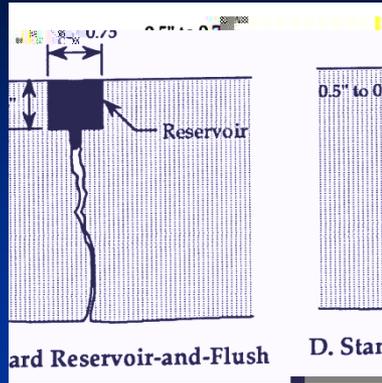
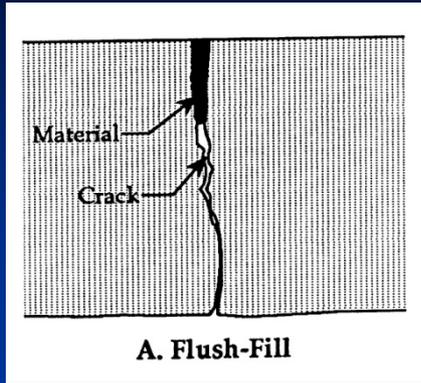
Rout Recommendation:

- No wider than 1 1/2"
- No less than 1/2" depth
- Cut at least 1/8" from each side of existing crack-- sound pavement

Basic Needs- all installations

- **Clean**
- **Dry**
- **Intact pavement**
- **Proper temperature**
 - **Pavement**
 - **Sealant**

Installation Choices



Sealant Application - Overband

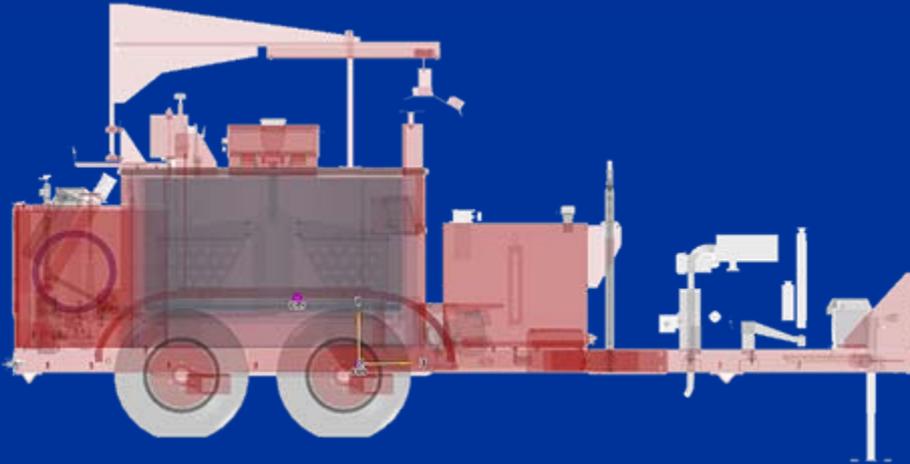
Max 1/8" thick

2" over-band on each side of crack

Longest performance (SHRP/FHWA)

Proper Equipment

Melter Applicator



- *Oil-jacketed*
- *Thermostatic heat controls*
- *Continuous agitation*
- *Over-heating safety controls*
- *Right size for operation*
- *Many commercial versions...*

Summary

Crack Treatment Steps

- Pavement evaluation
 - Crack Type Working or Non Working
- Determine Treatment
 - Crack Sealing or Crack Filling
- Select Sealant
 - Determine temperature (high/low extremes)
 - Consider Traffic Conditions
- Proper Application

***THE SAME STEPS AS ANY OTHER
TREATMENT DESIGN PROCESS***

Summary- Why Crack Treatment?

- Prevents water intrusion into pavement/base
- Prevents incompressible intrusion
- Maintain ride quality smoothness
- Slow pavement deterioration
- *CRACK TREATMENTS ARE THE MOST COST-EFFECTIVE PRESERVATION TREATMENT!*

Why Crack Treatment?

“With proper and timely application, crack sealing and filling can extend pavement life past the point where the cost-benefit of added pavement life exceeds the cost of conducting the operation” (FHWA-RD-99-147)

